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Does the HOTS Based Inquiry Training Learning Model Improve Children's Critical Thinking Skills in Islamic Religious Education Learning? Meta-analysis

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Abstract
This study aims to determine the influence of HOTS-based inquiry training model on critical thinking skills in PAI learning meta-analysis. Research data were obtained from 26 studies that met the inclusion criteria. Research data was obtained through the databases of ERIC, ScienceDirect, Wiley, Taylor of Francis, Mendeley and IEEE. Data analysis calculates the effect size value with the help of the JASP application. The results of the study concluded that the mean effect size value after analysis was found to be d =1.150 ; p < 0.001; z = 9.273.. These findings explain that the HOTS-based inquiry training model has a positive effect on children critical thinking skills in PAI learning. This research provides important information in the application of this model to encourage children's critical thinking skills in learning Islam.

Keywords: *Inquiry Training; HOTS; Critical Thinking; PAI*

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Introduction

In the era of globalization and the industrial revolution 5.0, Higher Order Thinking Skills (HOTS) are very important competencies for children to face complex challenges in various areas of life (Suryono et al., 2023; Asnur et al., 2024; Ulum, 2022). HOTS includes critical thinking, creative thinking, and deep problem-solving skills, which enable individuals to analyze, evaluate, and create innovative solutions (Rais et al., 2018). In the context of education, the application of HOTS not only helps children understand concepts more deeply, but also builds independence in thinking, hones reasoning skills, and increases adaptability to the rapid development of technology and information. Therefore, the modern education system must integrate learning strategies that encourage HOTS so that children can develop into competitive individuals and ready to face changing times (Astalini et al., 2023; Ong et al., 2020); (Zulkifli et al., 2022; Luciana et al., 2024; Dewanto et al., 2023).

Along with the increasing demands of 21st century skills, HOTS has become a major focus in curriculum reform in various countries, including Indonesia (Syahgiah et al., 2023). The implementation of HOTS in learning requires a change from a conventional rote-based approach to a more active approach, such as inquiry-based, project-based learning, and

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discussion methods that challenge Children' thinking. Research shows that children who are used to HOTS-based learning tend to excel in decision-making, complex problem-solving, and innovation compared to those who rely solely on low-level understanding (Bilgin, 2009; Adnan et al., 2021). Therefore, educators need to design strategies that not only facilitate theoretical understanding of concepts, but also encourage children to apply their knowledge in real-life situations, so that they have skills that are relevant to the needs of the world of work and modern society (Çorlu & Çorlu, 2012; Margunayasa et al., 2019; Nunaki et al., 2019; Hariyadi et al., 2023; Santosa & Sudirman, 2023)

Islamic Religious Education (PAI) learning has an important role in shaping the character and spiritual values of Children, but still faces challenges in developing children's critical thinking skills (Popova & Jones, 2021; Prayogi et al., 2018). One of the main obstacles is the learning approach that is still dominated by lecture and memorization methods, which tend to be instructional and lack of exploration and deep reflection on religious concepts (Khasawneh et al., 2022). Learning models that emphasize more on dogmatic understanding often make Children passive in criticizing or analyzing religious teachings in the context of daily life. As a result, Children tend to memorize without deeply understanding the meaning of Islamic teachings and their relevance to social and moral challenges in the modern era (Justice et al., 2007; Bilgin, 2009); (Ali et al., 2024; Wantu et al., 2024).

In addition, limited resources and lack of training for educators in implementing learning strategies based on Higher Order Thinking Skills (HOTS) in PAI are also significant obstacles. Many teachers still focus on low-level cognitive achievements, such as remembering facts and answering questions textually, without giving Children room to develop critical, analytical, and reflective thinking skills (Ramlee et al., 2019; Komala et al., 2020). The lack of integration of active learning methods, such as inquiry-based learning or problem-based learning, also hinders Children from exploring Islamic values in a more in-depth and contextual way. In addition, there is a perception that questioning or critically analyzing religious concepts can be considered inconsistent with traditional norms is also a challenge in developing children's critical mindset (Akinwumi & Bello, 2023; Lotter et al., 2016). Therefore, innovation is needed in PAI learning by adopting a more interactive and HOTS-based approach so that Children can understand, analyze, and apply Islamic values in a more contextualized and relevant way to their lives (Akinwumi & Bello, 2023). Because it is necessary, there is a model that can improve critical thinking skills in children, one of which is the inquiry training model.

The Higher Order Thinking Skills (HOTS)-based Inquiry Training Learning model is a learning approach that emphasizes exploration, investigation, and reflection, so that it can effectively encourage the development of critical thinking skills in children (Margunayasa et al., 2019). This model requires Children to ask questions, find solutions, and analyze information independently, which is a key aspect of critical thinking. In the learning process, Children are invited to identify problems, develop hypotheses, collect data, and draw conclusions based on empirical evidence (Nunaki et al., 2019; Justice et al., 2007; Acar & Tuncdogan, 2019). This approach not only strengthens the understanding of concepts, but also trains Children in organizing information, evaluating arguments, and making rational, logic-based decisions (Nasution, 2018). Thus, the HOTS-based Inquiry Training Learning Model creates a more dynamic learning environment, where Children not only passively receive information but are also active in building their own knowledge (Mitarlis et al., 2020).

In addition, the HOTS-based Inquiry Training Learning Model also contributes to improving Children' argumentation, problem-solving, and creativity skills(Ertikanto et al., 2017). Through this approach, Children are invited to question the phenomena that occur around them, connect theory with practice, and critically test the truth of information. In the context of Islamic Religious Education (PAI), for example, this model allows Children to examine Islamic teachings from various perspectives, understand their relevance to modern life, and develop a reflective attitude towards spiritual and social values (Popova & Jones,

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2021). By cultivating the habit of critical thinking from an early age, Children become more independent in understanding and applying religious concepts, and are able to adapt to complex changes and challenges. Therefore, the integration of HOTS-based Inquiry Training Learning Model in education is an effective strategy to produce a generation that not only has strong knowledge, but is also able to think analytically, innovatively, and reflectively in dealing with various life situations (Prayogi et al., 2018; Khasawneh et al., 2022; Syahgiah et al., 2023).

Penelitian yang dilakukan oleh (Wu, 2021; Turnip et al., 2016) It was found that the inquiry learning model has a positive impact on improving Children' critical thinking skills, especially in the aspects of analyzing, evaluating, and creating solutions to a problem. This study shows that an inquiry-based approach encourages Children to be more active in exploring information, building hypotheses, and testing the correctness of a concept through systematic investigation. In addition, the results of this study also revealed that Children who learn with the Inquiry Training model are more able to ask reflective questions and construct logic-based arguments compared to Children who use conventional learning methods. Research conducted by (Ertikanto et al., 2017) In the context of HOTS-based learning, it was found that the application of the Inquiry Training Learning Model can significantly improve children's critical thinking skills, both in the fields of science and social sciences, including in Islamic Religious Education (PAI).

Although the HOTS-based Inquiry Training learning model has been widely applied in various disciplines, research specifically examining its effectiveness in Islamic Religious Education is still limited. Most previous studies have focused on science and mathematics subjects, while their impact on children's critical thinking skills in Islamic religious learning has not been systematically synthesized. In addition, the approach used in previous studies was more of an experimental study with limited sample coverage, without a meta-analysis that could provide a comprehensive picture of the effectiveness of this model in various educational contexts. Variations in the implementation of Inquiry Training are also a factor that has not been studied much, especially related to differences in curriculum, education levels, and teaching approaches in Islamic Religious Education. Therefore, this study aims to fill this gap by conducting a meta-analysis to synthesize empirical evidence regarding the effectiveness of HOTS-based Inquiry Training in improving children's critical thinking skills in Islamic Religious Education.

Methodology

This study uses a meta-analysis approach to determine the the influence of HOTS-based inquiry training model on critical thinking skills in PAI learning. Meta-analysis is a research approach that evaluates previous research statistically to reach a conclusion (Tamur et al., 2020; Badawi et al., 2023; Nurtamam et al., 2023; Zulyusri et al., 2023). The meta-analysis research procedure is 1) determining the research inclusion criteria, 2) collecting data and coding, 3) analyzing the data statistically.
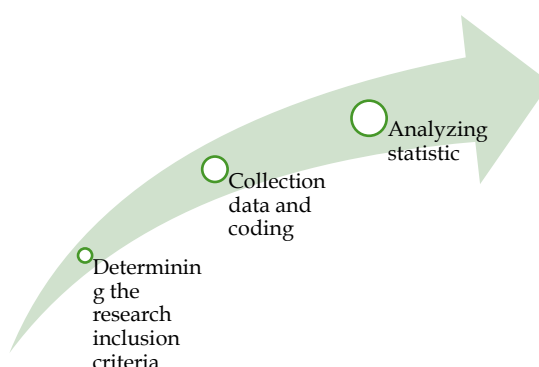
Figure 1. Meta-analysis Research Process

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Eligibility Criteria

In the process of searching for data through the Google Scholar, ScienceDirect, Wiley, ERIC, ProQuest, Fronteins and Web of Science databases, the research must meet several inclusion criteria, namely 1) the research is published in the 2022-2025 range, 2) the research is published in a journal indexed by SINTA, Scopun or Web of Science, 3) Relevant Research; 4) All studies must have complete data to calculate the effect size value. From the data search, 26 studies were obtained that met the inclusion criteria published in 2022-2025 which can be seen in Table 2.

Statistical Analysis

Data analysis in this study calculates the effect size value of each study analyzed. The effect size value in this study is to calculate the effect of the influence of HOTS-based inquiry training model on critical thinking skills in PAI learning. According to (Borenstein et al., 2007) The stages of data analysis in the meta-analysis can be seen in (Figure 1.). Furthermore, effect sizes the criteria Sawilowsky (2009) suggested were based on 0.01=very small, 0.2=small, 0.5=medium,0.8=large, 1.2=very large, and 2.0 =huge.

Result and Discussion

Based on the results of data search through the database, 26 studies/articles met the inclusion criteria. The effect size and error standard can be seen in Table 2.

Based on Table 2, the effect size value of the 26 studies ranged from 0.28 to 2.52. According to Borenstein et al., (2007) Of the 26 effect sizes, 8 studies had medium criteria effect sizes and 18 studies had high criteria effect size values. Furthermore, 26 studies were analyzed to determine an estimation model to calculate the mean effect size. The analysis of the fixed and random effect model estimation models can be seen in Table 3.

Table 2. Effect Size and Standard Error Every Researc

Code Journal	Years	Effect Size	Database	Standard Error
Y1	2025	2.52	ERIC	0.51
Y2	2025	1.92	ERIC	0.30
Y3	2023	0.77	Google Scholar	0.18
Y4	2024	0.82	Google Scholar	0.27
Y5	2024	1.17	Google Scholar	0.33
Y6	2025	1.35	Google Scholar	0.39
Y7	2022	0.62	ERIC	0.28
Y8	2024	0.96	Sciencedirect	0.40
Y9	2023	0.41	Google Scholar	0.22
Y10	2025	1.19	Google Scholar	0.44
Y11	2024	1.67	Wiley	0.41
Y12	2024	2.36	Wiley	0.43
R13	2024	0.91	ProQuest	0.30
Y14	2025	0.78	Google Scholar	0.28
Y15	2022	0.69	Wiley	0.18
Y16	2022	0.55	ERIC	0.13
Y17	2023	0.28	ERIC	0.10
Y18	2023	0.97	IEEE	0.36
Y19	2024	2.06	Google Scholar	0.49
Y20	2024	2.18	Google Scholar	0.38
Y21	2023	0.99	Google Scholar	0.29
Y22	2025	0.64	Google Scholar	0.20
Y23	2022	1.06	Google Scholar	0.33
Y24	2025	2.38	Google Scholar	0.34
Y 25	2023	0.90	Google Scholar	0.30
Y 26	2024	1.66	Google Scholar	0.31

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Based on Table 3, a Q value of 133.104 was obtained higher than the value of 85.987 with a coefficient interval of 95% and a p value of 0.001 <. The findings can be concluded that the value of 26 effect sizes analyzed is heterogeneously distributed. Therefore, the model used to calculate the mean effect size is a random effect model. Furthermore, checking publication bias through funnel plot analysis and Rosenthal fail safe N (FSN) test (Tamur et al., 2020; Badawi et al., 2022; Ichsan et al., 2023b; Borenstein et al., 2007). The results of checking publication bias with funnel plot can be seen in Figure 2.

Table 3. Fixed and Random effect

	Q	df	p
Omnibus test of Coefficients Model	85.987	1	< 0.001
Test of Residual Heterogeneity	133.104	25	< 0.001
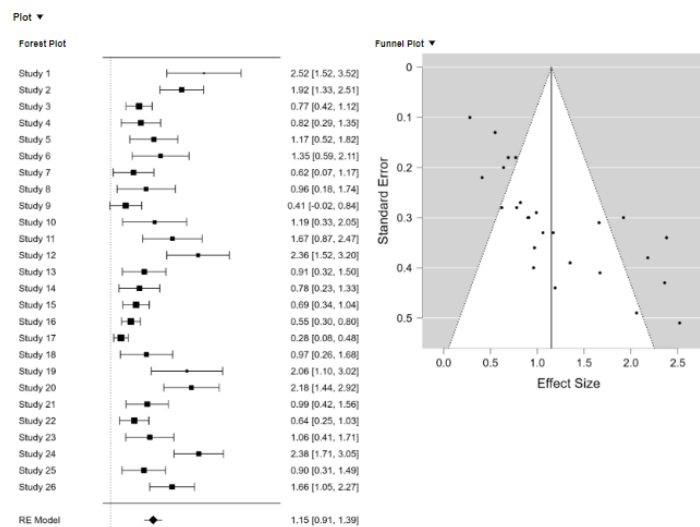
Figure 2. Funnel Plot and Forest Plot

Based on Figure 2, the analysis of the funnel plot is not yet known whether it is symmetrical or asymmetrical, so it is necessary to conduct a Rosenthal Fail Safe N (FSN) test. The results of the Rosenthal Fail Safe N calculation can be seen in Table 4.

Tabel 4. Fail Safe N

File Drawer Analysis			
	Fail Safe N	Target Significance	Observed Significance
Rosenthal	3590	0.050	< 0.001

Based on Table 4, the Fail Safe N value of 3590 is greater than the value of 5k + 10 = 5(26) + 10 = 140, so it can be concluded that the analysis of 26 effect sizes in this data is not biased by publication and can be scientifically accounted for. Next, calculate the p-value to test the hypothesis through the random effect model. The results of the summary effect model analysis with the random effect model can be seen in Table 5.

Tabel 5. Summary/ Mean Effect Size

Coefficient				
	Effect Size	Standard Error	z	p
Intercept	1.150	0.124	9.273	< 0.01

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Based on Table 5. The summary effect size value is 1,150 with a standard error of 0.124. These findings show that the HOTS-based inquiry training model model has a positive effect on children's critical thinking skills in PAI learning compared to the conventional learning model with a value of $z = 9.273$; $p < 0.001$ in the very high effect size category. The inquiry learning model based on Higher Order Thinking Skills (HOTS) has become the focus of research in an effort to improve Children' critical thinking skills, especially in the context of Islamic Religious Education (PAI) learning. This approach is designed to encourage Children to actively construct knowledge through an in-depth inquiry process, so that it is expected to strengthen their analytical and evaluative abilities. Meta-analysis of various studies shows that the application of HOTS-based inquiry models has a significant positive impact on improving Children' critical thinking skills in PAI learning.

In addition, another meta-analysis research by Karim (2022) examines the effectiveness of the Problem Based Learning (PBL) model on Children' critical thinking skills in PAI learning in Indonesia. Despite its focus on PBL, the results of this study are relevant because PBL also emphasizes the development of higher-order thinking skills (Muhaemin et al., 2023; Nasucha et al., 2023; Oktarina et al., 2021). This study found that the PBL model was very effective in improving Children' critical thinking skills, with an effect size value of 1.05 which was categorized as very high.Furthermore, research by Sari and Lutfi (2023) highlights the implementation of a guided inquiry learning model in improving Children' critical thinking and collaboration skills. Although this study does not specifically focus on PAI learning, these findings are relevant because they suggest that guided inquiry models can improve Children' critical thinking skills in a variety of learning contexts (Nurtamam et al., 2023; Elfira & Santosa, 2023). Overall, various studies show that the application of HOTS-based inquiry learning model is effective in improving Children' critical thinking skills, including in PAI learning (Ali et al., 2024). This approach encourages Children to be actively involved in the learning process, developing analytical, evaluative, and reflective skills that are essential in understanding and internalizing religious values. Therefore, the integration of the HOTS-based inquiry learning model in the PAI curriculum is recommended to improve the quality of learning and critical thinking skills of Children (Uluk et al., 2024).

Conclusion

From the results of this meta-analysis, it is explained that the mean effect size value after analysis is found to be $d = 1,150$; $p < 0.001$; $z = 9,273$. These findings explain that the HOTS-based inquiry training model has a positive effect on children's critical thinking skills in PAI learning. This research provides important information in the application of this model to encourage children's critical thinking skills in learning Islam. The HOTS-based Inquiry Training model not only succeeded in improving Children' critical thinking skills but also deepened their understanding of the religious concepts taught. The implications of these findings indicate that learning strategies designed to stimulate higher levels of thinking, such as analysis, evaluation, and creation, have great potential to change the way religious material is delivered and understood. Educators are expected to integrate this model into their teaching practices to achieve more optimal learning outcomes. In addition, this study also emphasizes the importance of further research to investigate the factors that influence the implementation of this model in various educational contexts, as well as ways to adapt this model to suit the diverse learning needs of Children. Thus, learning Islamic Religious Education can be more interactive, reflective, and effective in achieving broader educational goals.

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